

THE CALIFORNIA STANDARD COMPANY

C. D. MIMS
VICE-PRESIDENT
PRODUCING

CALGARY, ALBERTA

October 25, 1954.

The Petroleum and Natural Gas
Conservation Board,
Mines Branch,
Province of Manitoba,
WINNIPEG, Manitoba.

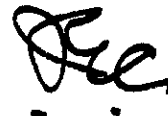
Gentlemen:

Attached please find one copy of the Proposal for Expansion
of the Daly Pilot Water Flood.

Yours truly,


C. D. MIMS

only s.e. 1/4 of Sec 11 to be included in aquit.
No intention of making Cal. Stan. well 1-11 a
water injection well (aquifer production 1320 bbls.)
with above change aquit OK.



October 25, 1954.

PROPOSAL FOR EXPANSION - DALY PILOT WATER FLOOD

The pilot water flood has been in operation over fifteen months. This report presents the results to date; the significance of these results; the conclusions which must be drawn and a proposal to expand the pilot water flood.

Results to Date

1. Daily production at 15-1 has increased from 7 barrels per day to 38 barrels per day.
2. Daly 3-12 has increased from 62 barrels per day to 120 barrels per day.
3. Daly 4-12 production increased from 75 barrels per day to 90 barrels per day and is currently 75 barrels per day.
4. Smaller production increases have been noted at 13-1, 5-12, and 6-12 (see rate cumulative curves attached).
5. Although not conclusively established, we believe the effect of the flood is starting to be felt at 12-1, 1-11 and 7-12. The low compressibility of the oil and connate water accounts for the repressuring of a rather extensive area. Assuming 50' of pay it only takes approximately 8000 barrels of water to raise the formation pressure in 40 acres from 1000 pounds to 2100 pounds.
6. The total daily water injection has declined from 2000 barrels per day to 730 barrels per day.
7. Recent attempts to increase injectivity by fracturing 16-1 and 10-1A have yielded very little increase.
8. A Carter Analyzer study made by C.R.C. indicates that:
 - (a) 15-1 will increase gradually during the next year to approximately 50 to 70 barrels per day.
 - (b) that approximately a total of 70 barrels per day of water is converging on 15-1 from the 4 injection wells.
9. No water breakthrough has been noted in any of the producing wells adjacent to the pilot flood.

Discussion

Since the injected water is not following radial behavior as in homogeneous sands it is necessary to revise our predictions of the behavior of the 80 acre 5 spot. The initial assumptions were that 1/4 of the total water injected i.e. 1/4 of 2000 barrels per day was moving in the direction of 15-1. Instead of this only 1/10 of the total water injected is approaching 15-1 or about 70 barrels per day. This means that the time required to determine recovery efficiency in the 80 acre 5 spot to breakthrough, is greatly extended.

In addition it is estimated that a large portion of the injected water (approximately 500 barrels per day) is moving into the higher permeability area 3-12, 4-12, etc. The significance of this is illustrated in the attached map B-6752-1 which shows the theoretical flood fronts. This suggests that water breakthrough can be expected at 3-12 within the next year. This type of water drive is similar to a staggered line drive in which water breakthrough is followed by a rapid increase in W.O.R.'s and oil production consequently declines rapidly.

Conclusions

- (a) In order to confirm recovery efficiency in the 80 acre 5 spot to breakthrough (by the most conservative prediction, Stiles method) approximately $2\frac{1}{2}$ years additional time will be required. Cumulative production 15-1 at September 30, 1954, 21,200 barrels.
Aug. 31, 1954
- (b) The nonradical behavior of the injected water suggests that the flooding pattern should be altered to take advantage of the heterogeneity of the producing formation.
- (c) It is highly probable that Daly 3-12 production will drop rapidly should water breakthrough occur as a result of the unbalanced pattern currently influencing 3-12.
- (d) The production rate of the 3-12, 4-12, 1-11 and 5-12 can be increased substantially by addition of water drive from the west.

Recommendations

It is recommended that the Daly Pilot Flood be expanded to include the following injection wells:

6-12
12-12
8-11

This limited expansion is proposed in order to:

- (1) contain the flood front advance in a westerly direction to prevent 3-12 going to water prematurely.
- (2) increase production in the better permeability area.

Predicted Results of Pilot Water Flood Expansion

Following fill-up and pressurization the average injection rates are estimated as follows:

		<u>Effective in Better Perm. Area</u>
14-1	210	175
8-11	200	165
2-12	210	160
6-12	150	115
12-12	<u>50</u>	<u>15</u>
	820 b/d	630 b/d

Based on these injection rates the future production is estimated as follows:

<u>Well</u>	<u>Current Daily Production</u>	<u>Est. Future Flood Production</u>	<u>Net Gain b/d</u>
13-1	24	24	-
1-11	51	65	14
3-12	115	303	188
4-12	72	112	40
5-12	<u>34</u>	<u>126</u>	<u>92</u>
	296	630	334
8-11	14	-	
6-12	18	-	
12-12	<u>8</u>	<u>-</u>	
	40		lost prod'n 40
			<u>294</u>
12-1	11	20	9
2-11	6	10	4
7-12	14	25	11
11-12	<u>18</u>	<u>25</u>	<u>7</u>
	49	80	31
TOTALS	<u>385 b/d</u>	<u>710 b/d</u>	<u>325 b/d</u>

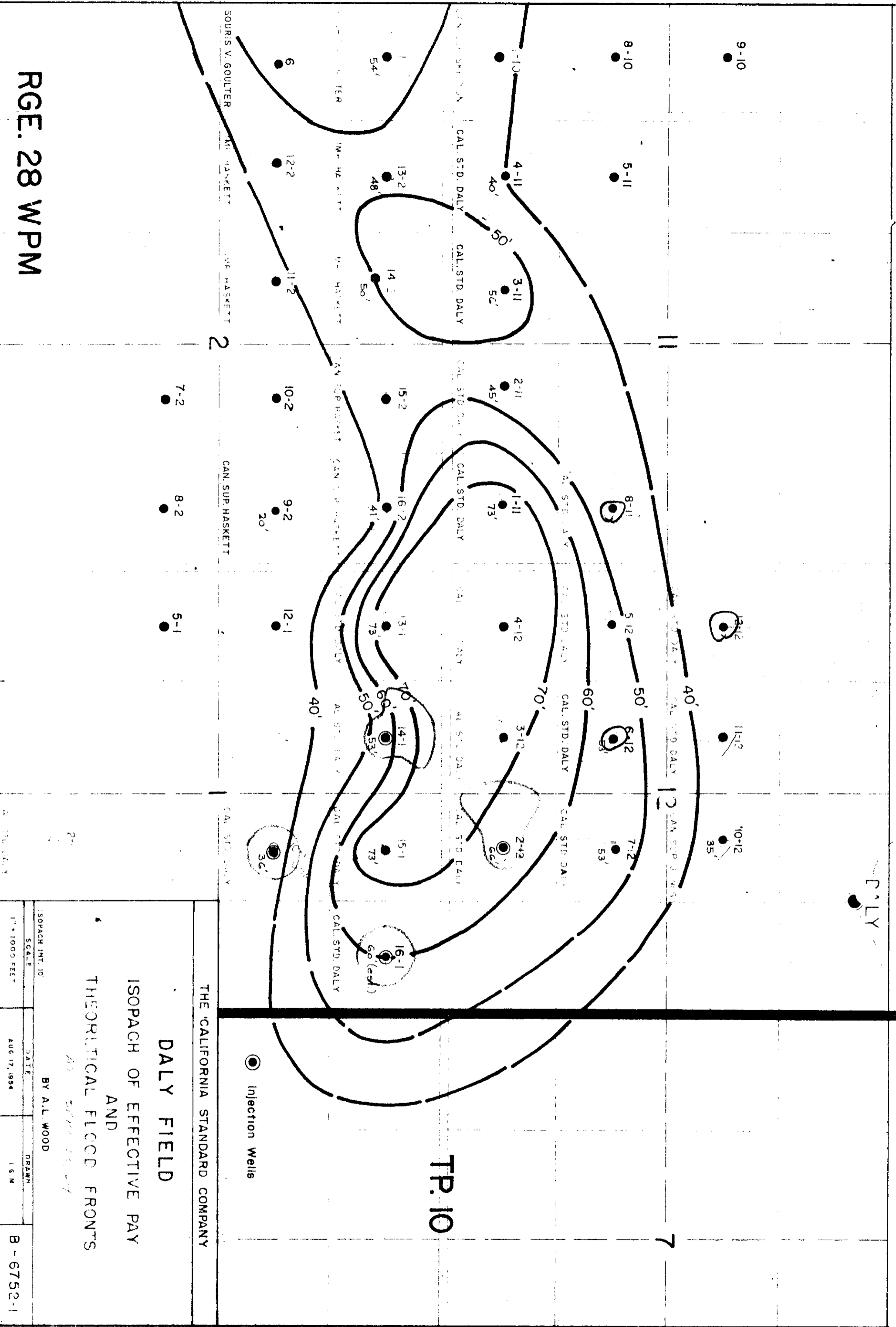
The production rates were estimated by a material balance consideration and must be modified for time lag. From the 3-12 decline curve it was assumed that the net gain would be 50% complete in 6 months, 75% complete in 1 year, and 100% complete in 1½ years.

Since water breakthrough is anticipated at 3-12 in one year's time it was further assumed that 4-12 would be converted to injection in one year's time. This would mean a loss in production at that time of approximately 110 b/d. However, with 4-12 on injection the 110 b/d loss would be made up by increases in 1-11, 5-12, 13-1 and 3-12.

The production increase by expanding the flood is estimated as follows:

<u>Year</u>	<u>Net Increase in Production</u>
1	140 b/d
2	200 b/d
3	325 b/d

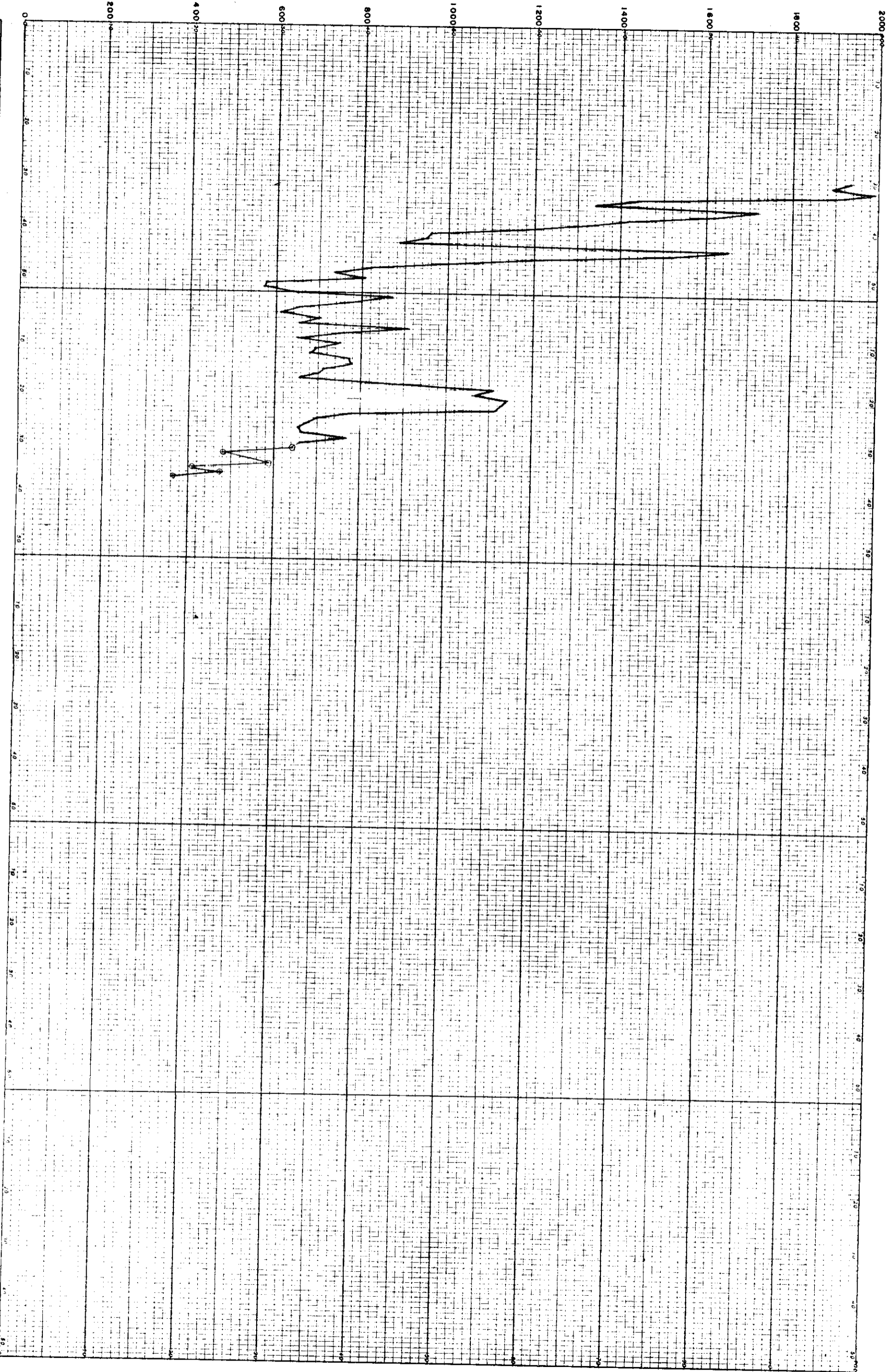
RGE. 28 WPM





INJECTION RATE B.P.D.

DAILY PILOT FLOOD
TOTAL DAILY WATER INJECTION



1953

1954

1955

1956

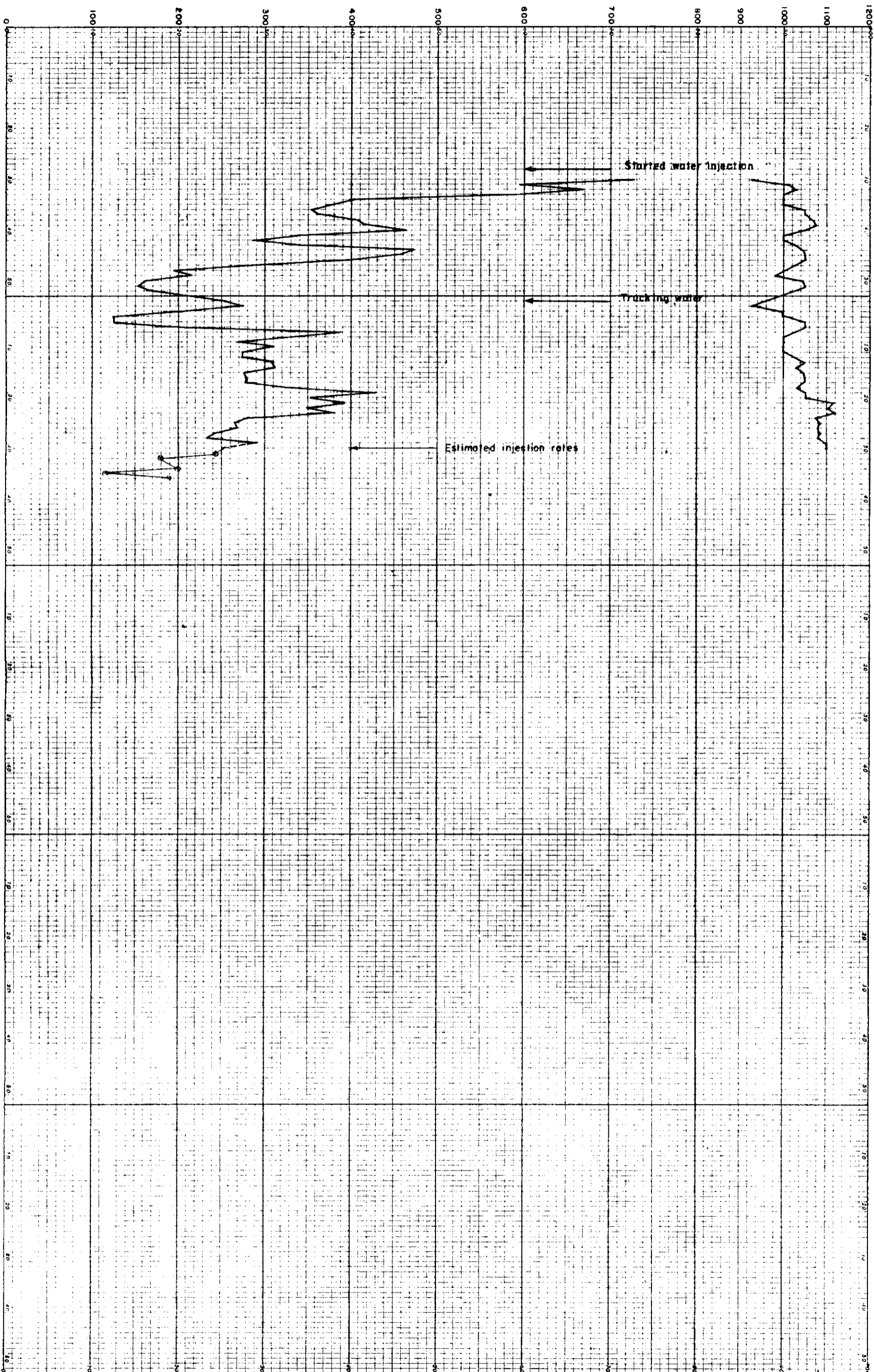
1957



INJECTION RATE BPD

INJECTION PRESSURE

WATER INJECTION CURVE
DAILY 14-1



1953

1954

1955

1956

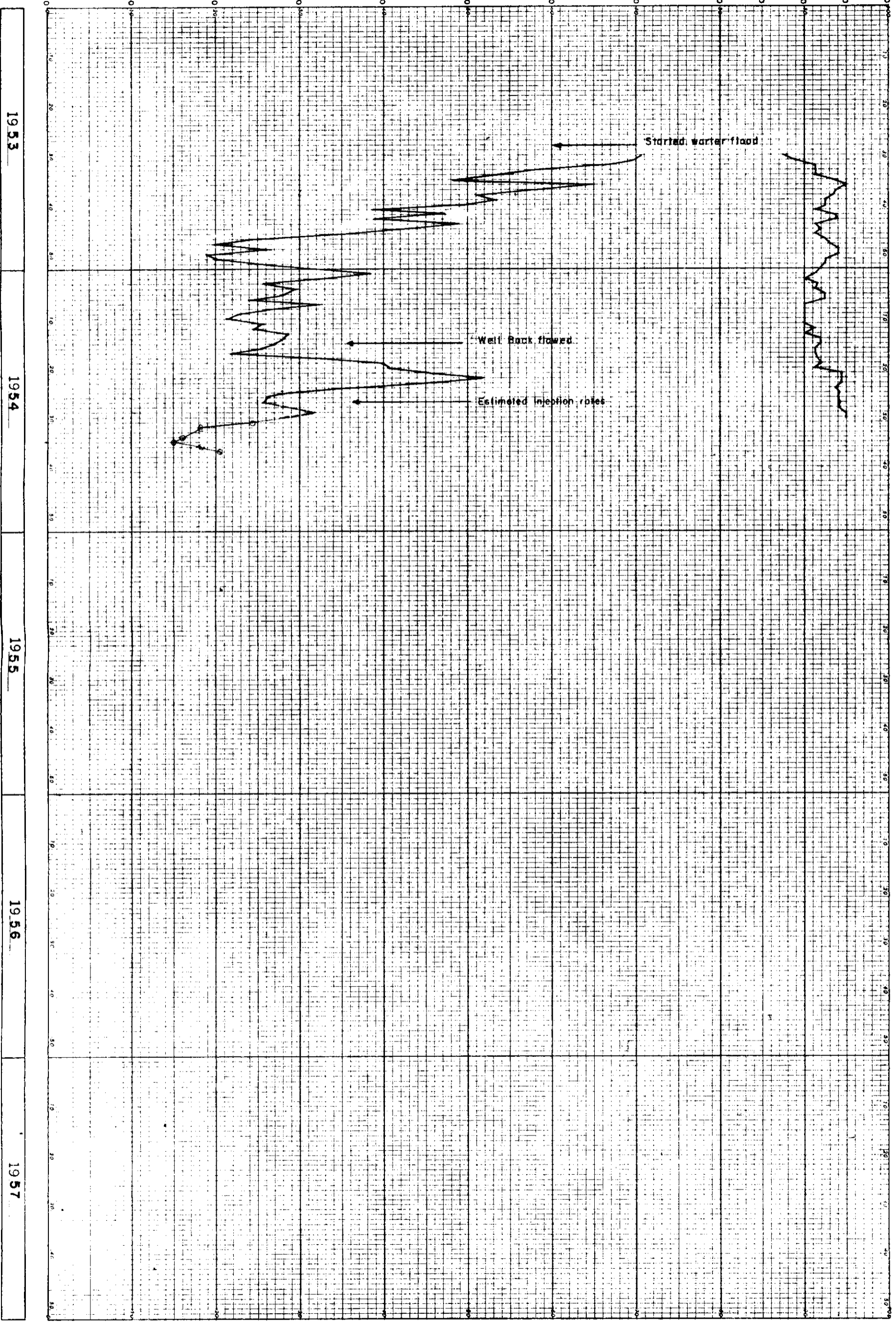
1957



INJECTION RATE BPD

INJECTION PRESSURE

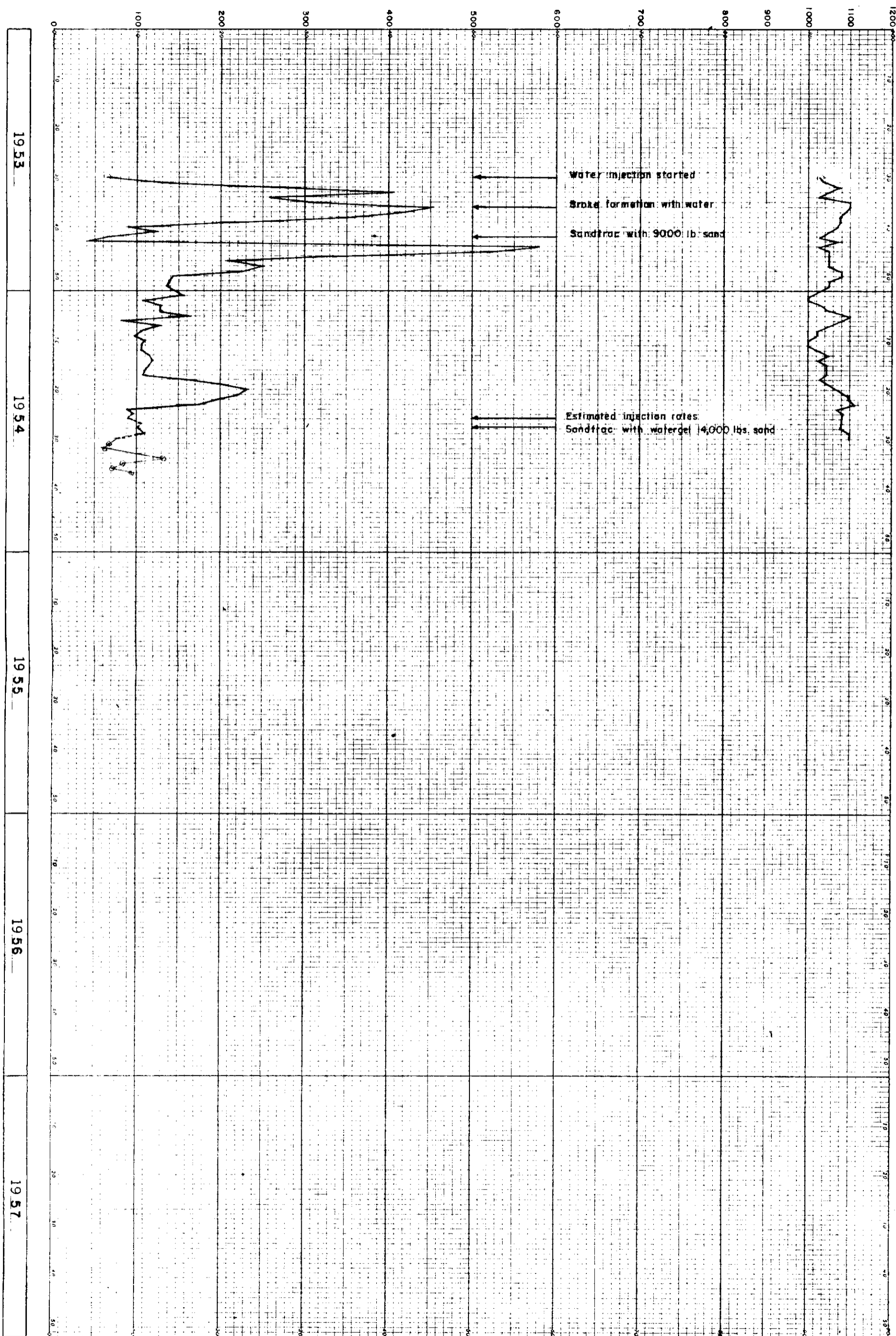
WATER INJECTION CURVE
DALY 2-12





INJECTION RATE BPD

INJECTION PRESSURE

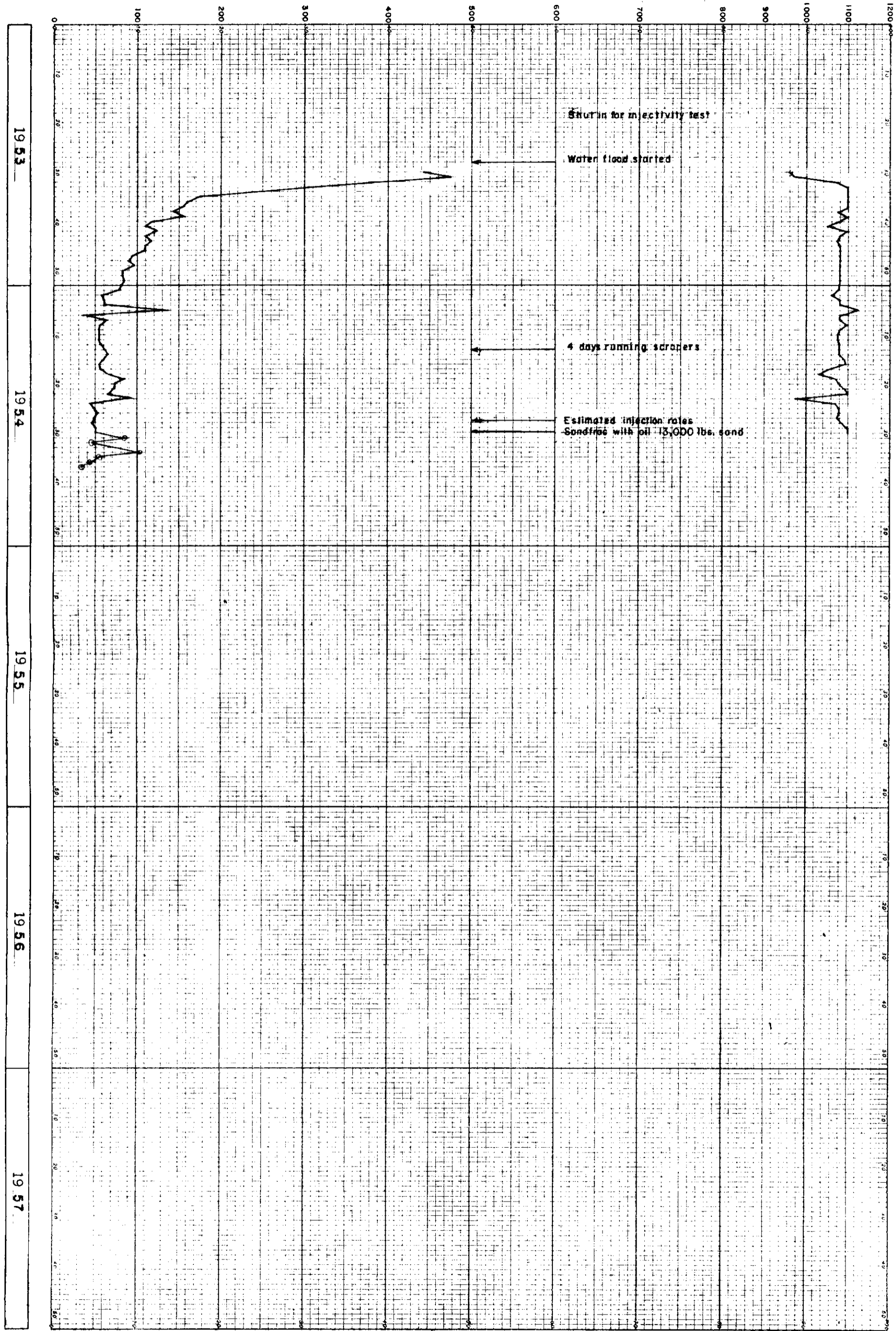


WATER INJECTION CURVE
Daly 16-1



INJECTION RATE BPD

INJECTION PRESSURE



WATER INJECTION CURVE
DALY 10-1A

1953

1954

1955

1956

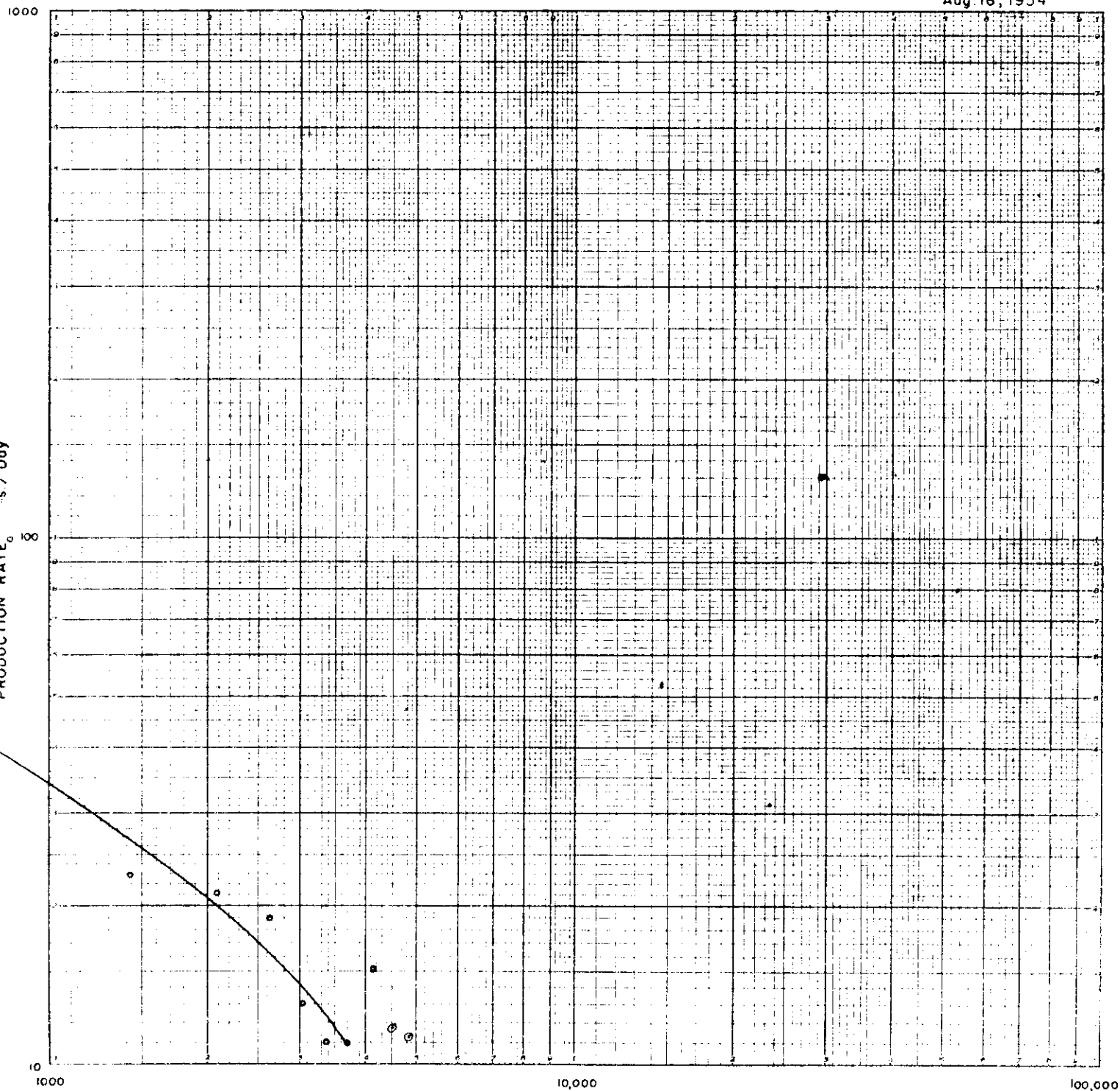
1957

RATE-CUMULATIVE DECLINE CURVE

FOR
DALY 12-1

Aug. 16, 1954

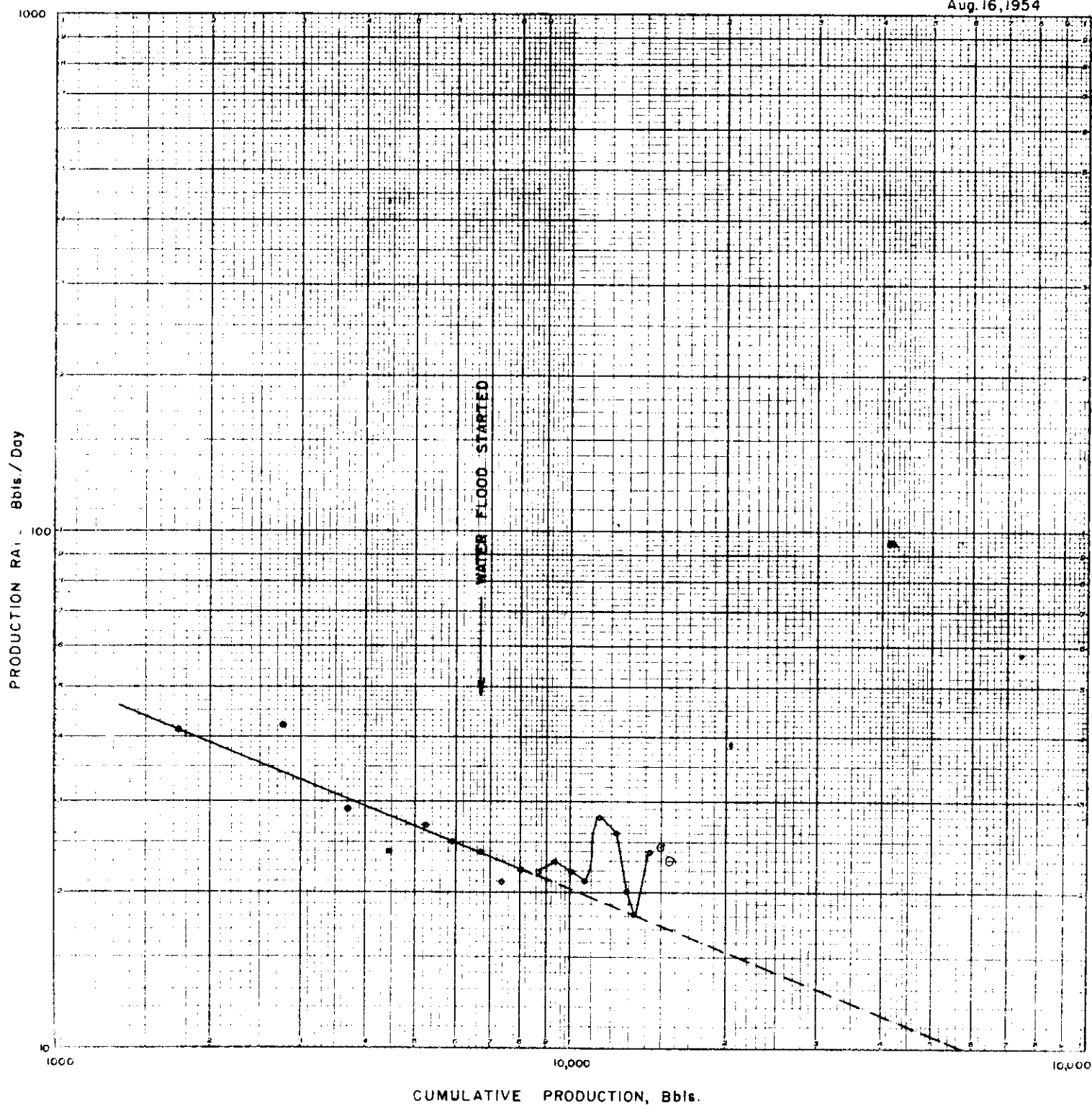
WATER FLOOD STARTED (before on prod) 10/1/54



CUMULATIVE PRODUCTION Bbls.

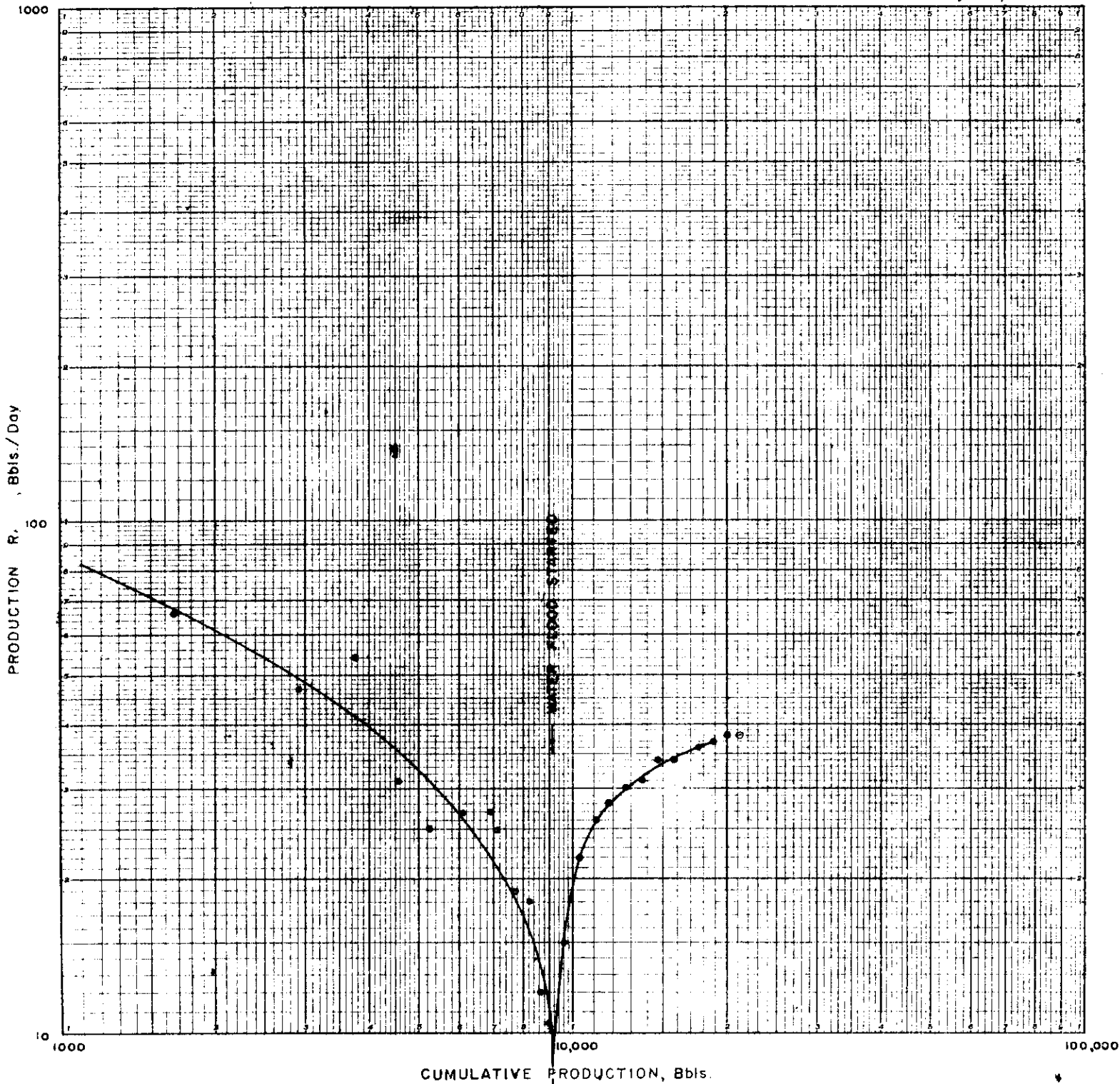
RATE - CUMULATIVE DECLINE CURVE FOR DALY 13-1

Aug. 16, 1954



RATE - CUMULATIVE DECLINE CURVE FOR DALY 15-1

Revised Aug. 16, 1954
July 27, 1953

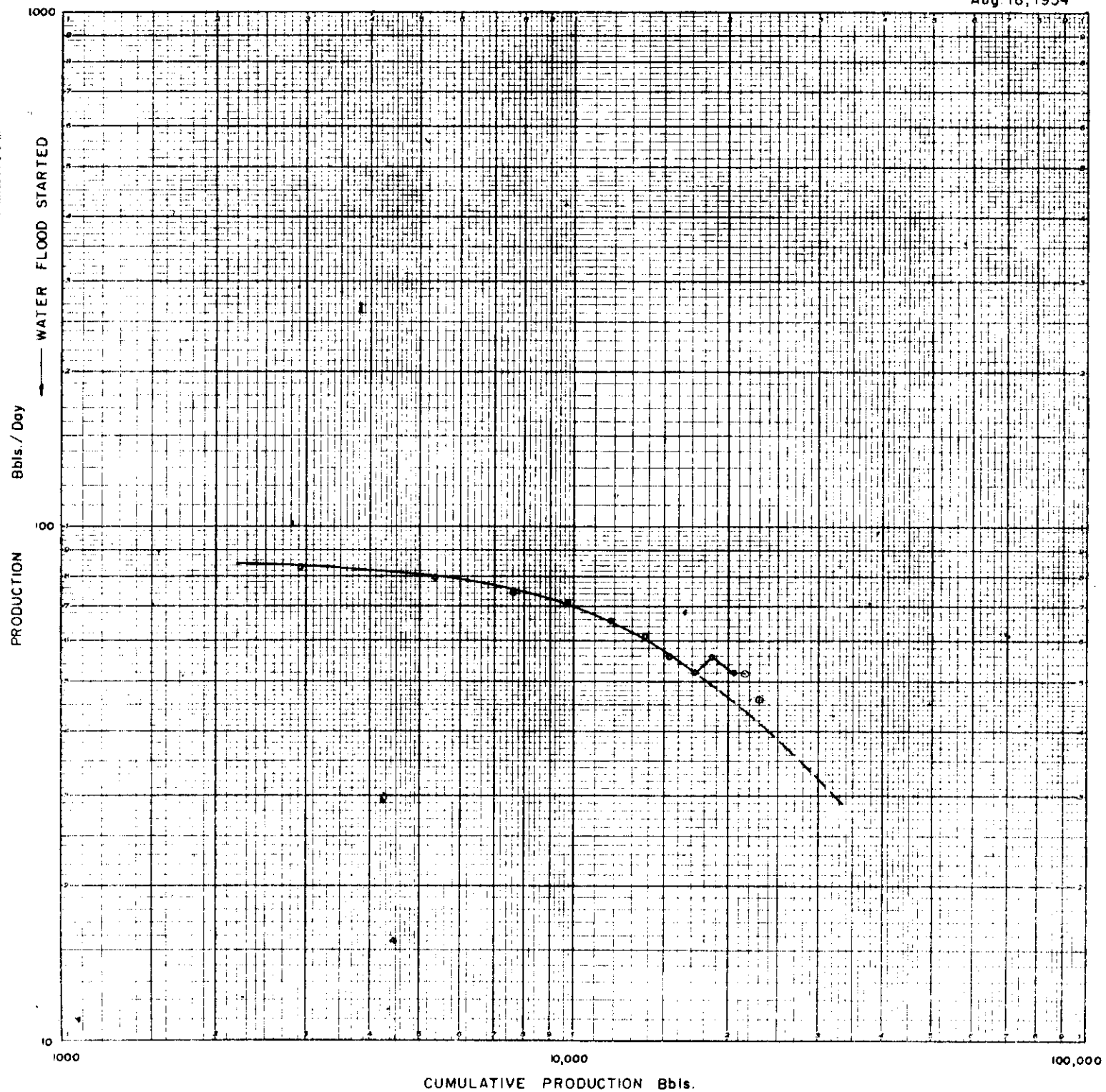


RATE-CUMULATIVE DECLINE CURVE

FOR
DAILY 1-11

Aug. 16, 1954

LOUISIANA OIL COMPANY, INC. A NEW YORK STOCK EXCHANGE LISTED COMPANY
PRINTED IN U.S.A.

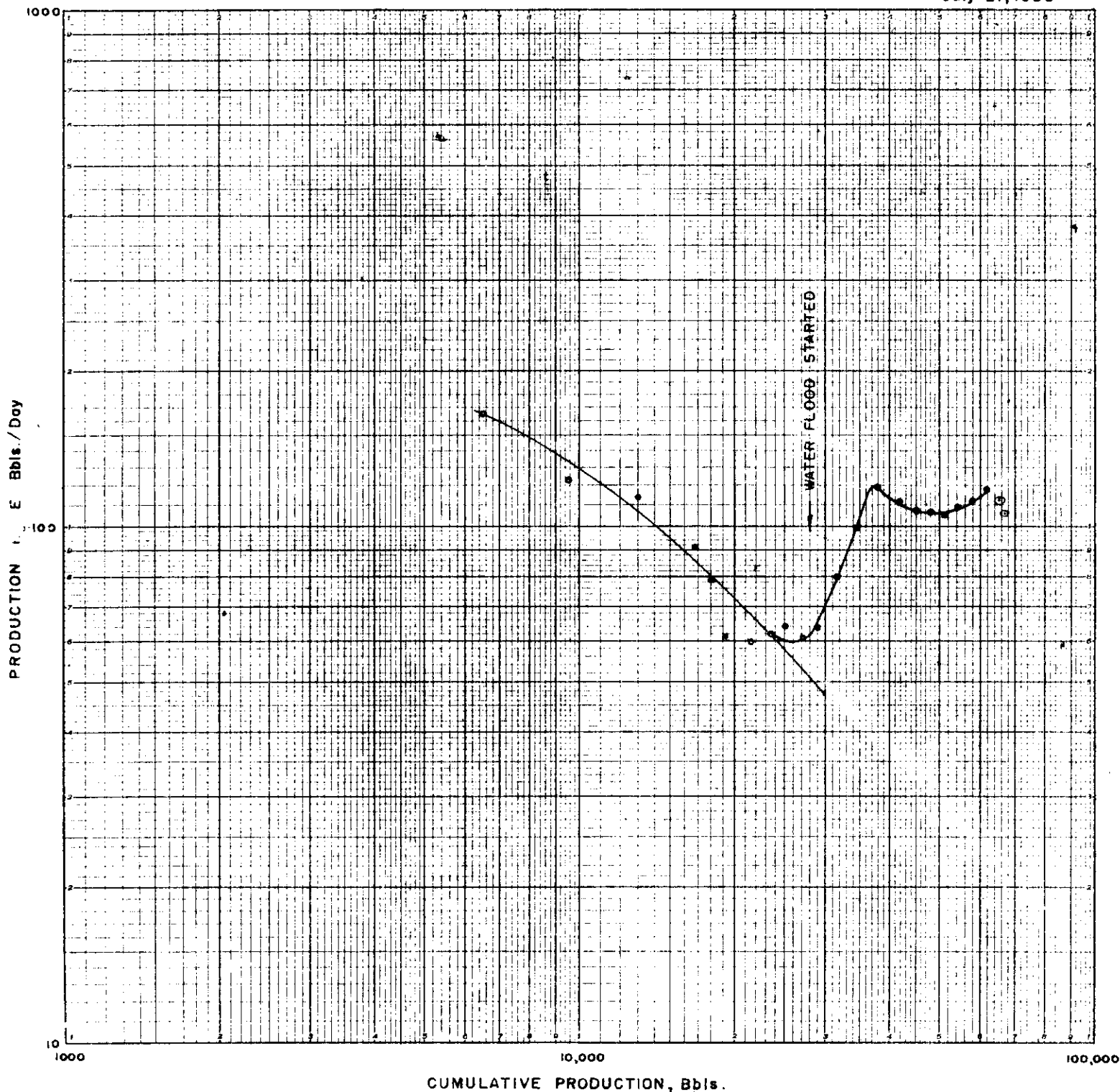


RATE - CUMULATIVE DECLINE CURVE

FOR
DALY 3-12

Revised Aug. 16, 1954
July 27, 1953

NO. 31.291. LOGARITHMIC 2 BY 2 3/4 INCH CYCLES / BASE SHORT WAY.
CODEX BOOK COMPANY, INC. NORWOOD, MASSACHUSETTS.
PRINTED IN U.S.A.



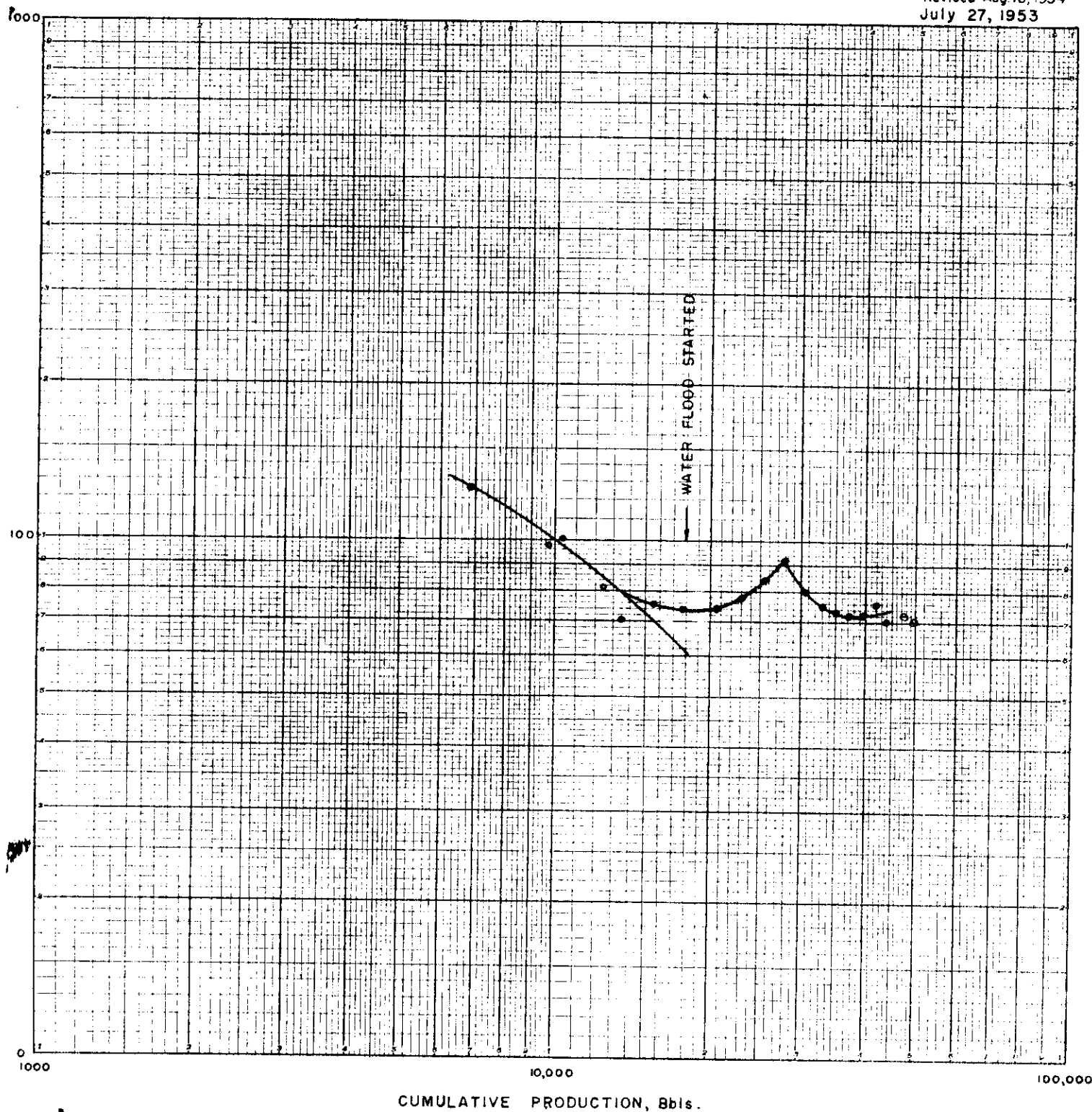
RATE - CUMULATIVE DECLINE CURVE FOR DALY 4-12

Revised Aug. 16, 1954
 July 27, 1953

CODEX BOOK COMPANY, INC. NORWOOD, MASSACHUSETTS.
 PRINTED IN U.S.A.

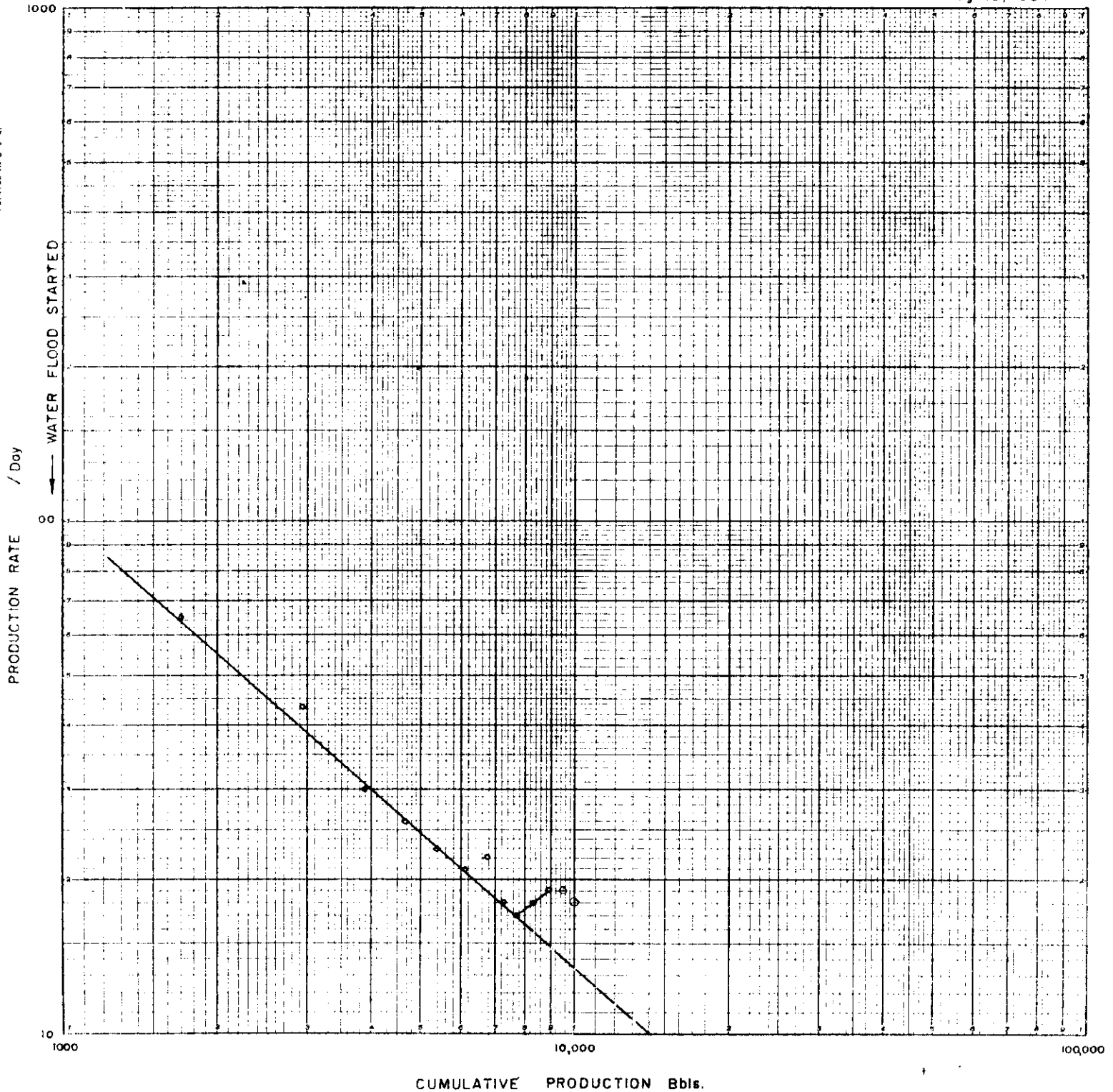
PRODUCTION R. E. Bbls./Day

NO. 31 291 LOGARITHMIC 2 BY 2 3/4 INCH CYCLES BASE SHORT WAY.



RATE - CUMULATIVE DECLINE CURVE FOR DALY 6-12

Aug. 16, 1954



RATE-CUMULATIVE DECLINE CURVE FOR DAILY 7-12

Aug. 16, 1954

